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Spectra of Southern Galaxies with Carnegie Image Tube

Thornton Page

Wesleyan University

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During February 1967 a cascaded image tube on loan to me from the Carnegie Institution of Washington was installed in the Fast Spectrograph at the Newtonian focus of the Cordoba 61-inch reflector at Bosque Alegre, Argentina. It was used to observe galaxies from 26 Feb. to 4 Mar. and showed a large gain in speed over the f/0.5 semi-solid Schmidt used earlier with Eastman 103aF film in the spectrograph. Twenty-four spectra were obtained of 20 galaxies and 5 stars.

The image tube developed by Drs. Merle Tuve and W. Kent Ford, Jr. of DDM, Carnegie Institution requires 20,000 volts provided by a Varian-Mikros high-voltage supply powered by 110 volts AC. A 110-volt power supply (and new telescope controls) had been provided by the Smithsonian Astrophysical Observatory, and installed at Bosque Alegre in Aug. 1966. The Smithsonian also purchased an f/0.87 Super-Farron of 3.6-inch aperture to focus the spectrum on the photo-cathode of the RCA C33011 tube. This, the tube and an Elgeet f/1.2 transfer lens were mounted by Dr. Ford in a 6.5-inch cylinder (Fig. 1) containing alnico bar magnets that produce a uniform magnetic field of about 225 Gauss along the axis of the tube. It was estimated that external magnetic fields of 100 milli-Gauss would displace the focussed spectrum by about 10 microns.

The 90-mm aperture of the Super Farron lens is less than the 97 x 63 mm. beam from the plane grating in the Fast Spectrograph, causing a 0.85 reduction in speed. The equivalent focal length of the Super Farron lens is 78 mm (larger than that of the semi-solid Schmidt camera) resulting in a dispersion of 290 A/mm. (instead of 480 A/mm.) and a further 0.4 reduction in speed. Moreover, the transmission of the 7-component, glass Super-Farron lens is 80% for wavelengths greater than 5500 A and drops to zero at 3900 A. Nevertheless, the image intensification of the RCA C 33011 focussed on Eastman 103a0 or Ila0 plates results in a gain of 10 or more for wavelengths from 5500 A to 7500 A.

Photographic focus tests were made for the Elgeet lens (focussing the phosphor screen on the plate), the high voltage (19000 volts) focussing the RCA tube, and the spectrograph collimator focussing the spectrum on the photo cathode. Fig. 2 is a 2.5 x enlargement of plate IT-27 with such focus tests on the Neon spectrum showing that the best settings are: Elgeet 0.90, voltage 19000, collimator 25.7. A rough magnetic survey of the region near the dome opening (where the image tube would be during exposures) showed that the horizontal component of the magnetic field changed by 100 m G from one side of the opening to the other, but spectra taken with the tube in these two positions showed no discernible shift.

The following spectra of galaxies were obtained, several with strong moonlight superimposed. Figs. 3 and 4 are 2.5 x enlargements, each with Ne comparison spectrum. (Starting from the left (yellow), the 5577 A night-sky line is seen, then 5852 A Neon, closely packed Ne lines to 6717 A and wider spaced ones to 7550 A. Then the second-order blue-green spectrum, ending on the right with the strong 5852 A Neon line.)

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<u>Galaxy</u>	<u>Type</u>	<u>Brightness</u>	<u>Slit width</u>	<u>Exposure</u>	<u>Plate Nos.</u>	<u>Remarks</u>
NGC 1511	Sa	$13^m.4/(')^2$	0.07 mm	90 min.	20	H $\alpha$ emission
1527	SO	12.8	0.12, 0.07	30, 60	26, 32	H $\alpha$ ?
1536	SBC	13.7	0.12	120	23	Clouds
1705	SO	12.9	0.12	30	26	H $\alpha$ emission
1796	Sb	13.5	0.12	60	34	
1947	SO	12.9	0.1, 0.12	30	16, 17	
2134	EO	13.2	0.12	85	21	
3059	SBb	14.0	0.12	60	34	
3136	E4	12.6	0.12	60	21, 23	H $\alpha$ ?
3223	Sb	14.0	0.12	60	34	
3258	Pair	12.8	0.07	30	33	H $\alpha$ ?
3270	Pair	13.0	0.09	60	33	
3318	Sa	13.7	0.12	45	32	H $\alpha$ emission
3783	SBa	13.4	0.09	60	33	H $\alpha$ emission
4373	Pair	12.9	0.09	45	33	
4835	SBC	13.7	0.12	60	34	
4945	SBC	13.7	0.12	60	35	

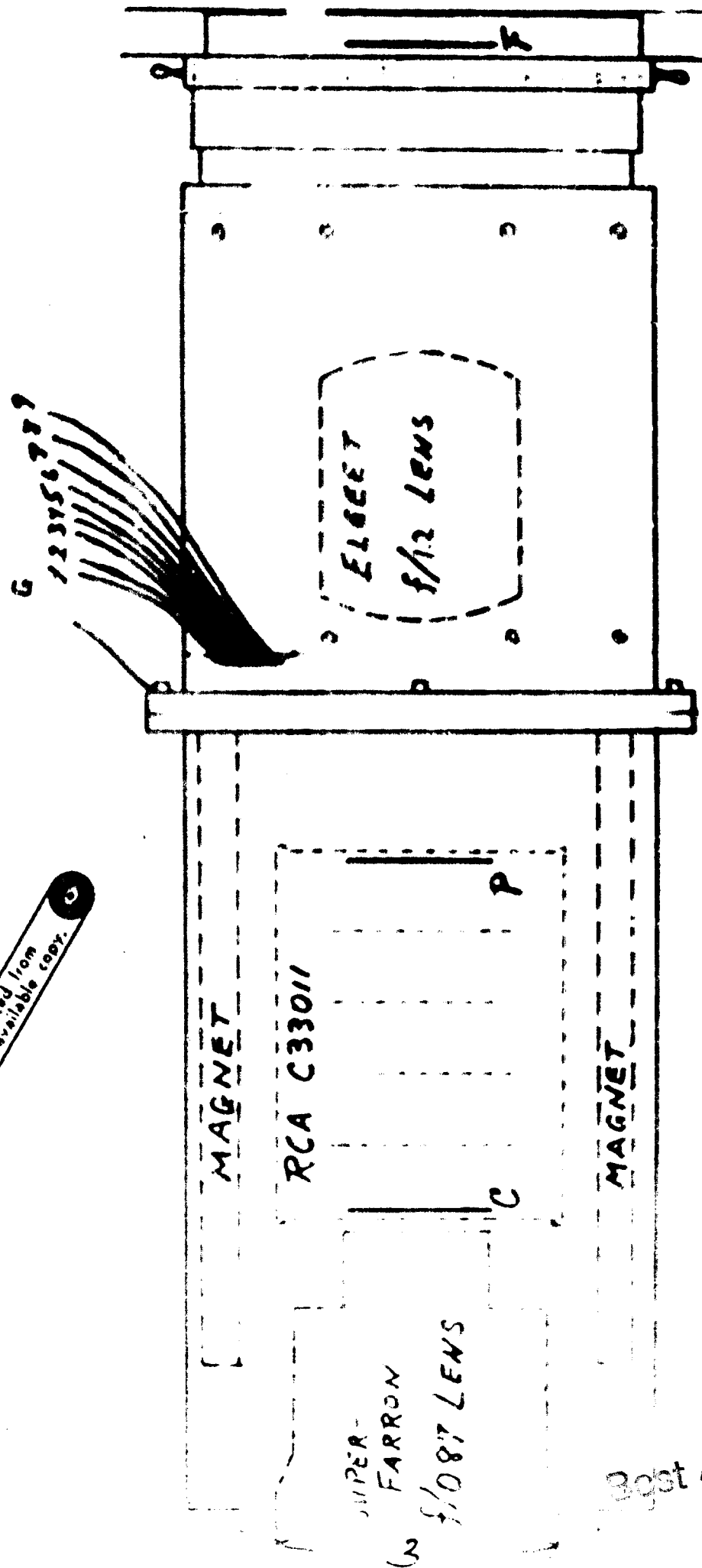
#### Stars

F5	5 <sup>m</sup>	0.02	1.0	24
K0	5.	0.02	2.5	21
K	7.5	0.02	6.	22
K0	6.5	0.02	12.5	24
M	8.	0.02, 0.07	6.5	22, 23

<u>Calibrations</u>	--	---	---	15, 30	32, 33, 34, 35
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The galaxy spectra will be measured for redshifts and internal motions, and (with the microdensitometer) for line intensities and intensity distribution. It was for the latter purpose that star spectra were obtained, and the plates calibrated with a sensitometer.

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C<sup>+</sup> Cathode  
P<sub>o</sub> Phosphor Screen  
F<sub>o</sub> Photo Plate

Fig. 1  
Image Tube Cylinder, 1/2 Scale

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IT 27

TEST

DOWN |||

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19.5

DOWN |||

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18.5

70

DOWN |||

|||

19.0

50

DOWN |||

|||

hV

90

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Newell



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25.2

Coll.

Fig. 2

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IT-26

NEL

1527

1765

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28 EL 17

no filter

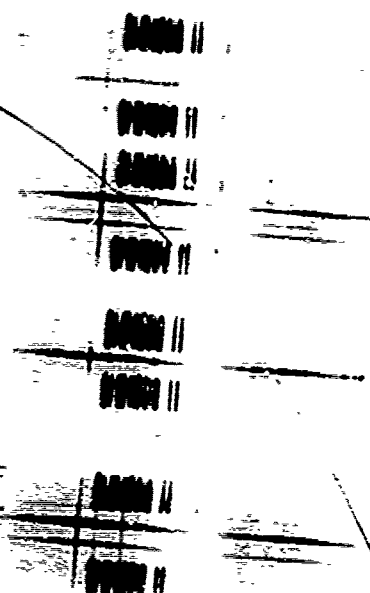
Fig. 3

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IT-33

X

NEC



3258

3270

3783

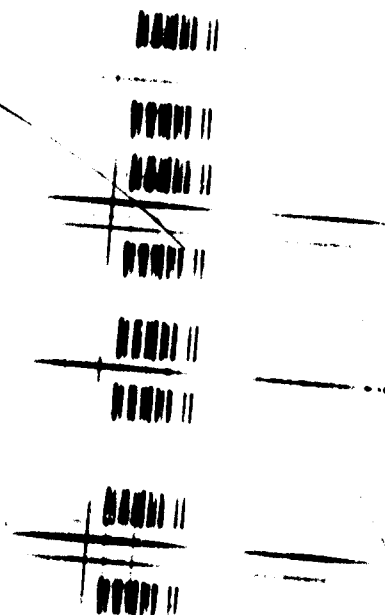
3785

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Fig. 4 no filter

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IT-33

MEC



32.58

32.70

32.83

32.95

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